NOAA ROSES Semi-Annual Report

Reporting Period: September 2020 – February 2021 (1st report)

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Project Title: Enhancing forecast applications of the GOES-R GLM in tropical cyclones using multi-platform data fusion and AI to assess environment and storm structure

Executive Summary (1 paragraph max)

This project aims to utilize machine learning to aid in the development of an automated real-time predictive tool that can assess links between the Geostationary Lightning Mapper (GLM), tropical cyclone (TC) structure, and TC intensity change to improve intensity forecasts. The Year 1 milestones focus on data collection and data processing in anticipation for the machine-learning training and tool development in Years 2 and 3. The project is on track to achieve all Year 1 milestones on time and early work has begun on future milestones. The core project team holds bi-weekly meetings to maintain communication and keep the project on track.

Progress toward FY20 Milestones and Relevant Findings (with any Figs)

Year 1 milestones are focused on collection, assembly, and intercomparisons of the machine-learning data inputs. The bulk of this reporting period was focused on re-gridding the data to a common grid and applying appropriate quality control. The following datasets were collected and re-gridded to the GOES ABI grid and/or a 0.02° grid:

Lightning: GLM, WWLLN
Satellite imagery: ABI
Environmental data: Aerosol Optical Depth (AOD), GFS 0.25° analysis, GFS deep-layer vertical wind shear, Ocean Heat Content (OHC), Sea Surface Temperatures (SST)
Other: Land masks, distance to land grids

Additional datasets that were collected with no additional processing yet include:

Lightning: ISS-LIS (quality-controlled dataset released in December 2020)
TCs: ATCF a-decks, ATCF b-decks, SHIPS model database

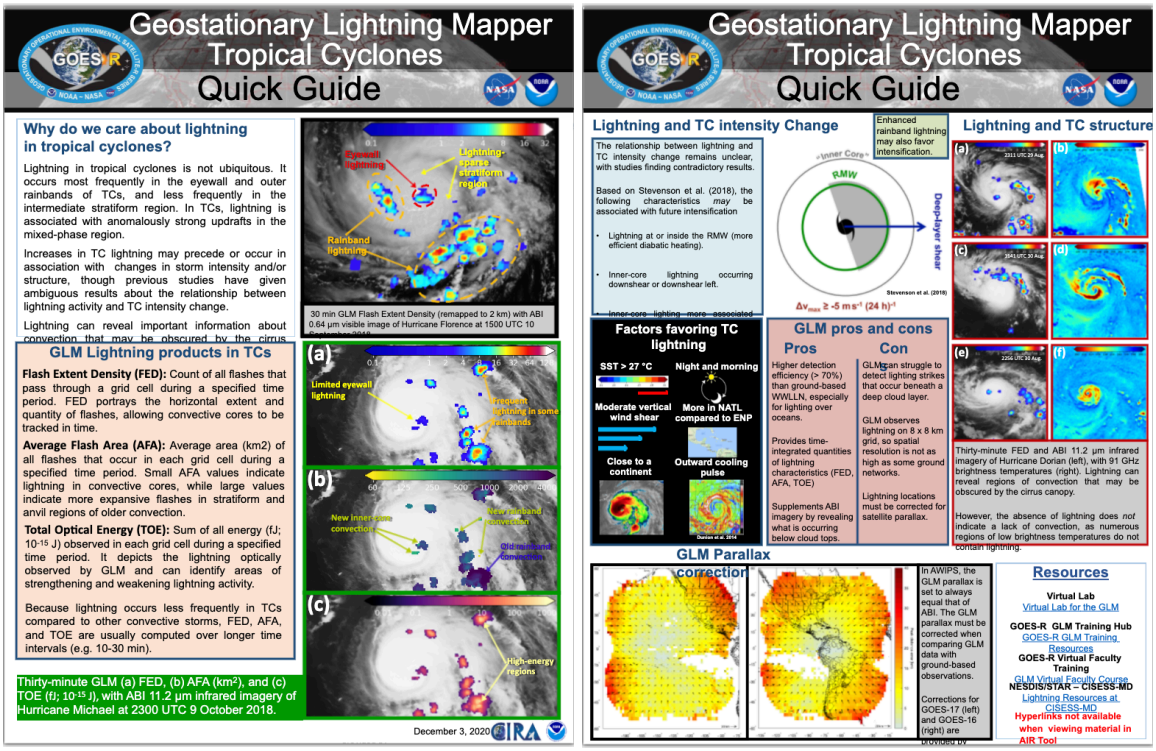
Year 2 milestones were also started during this period. Initial machine-learning training datasets were assembled and sample sizes for overlapping data were examined. Machine learning can be an iterative process and we have taken the approach of starting this process early.

Deliverables completed during this reporting period include:

1) AGU Poster Presentation:

Kowaleski, A., S. Stevenson, K. Musgrave, and K. Hilburn, 2020: Enhancing Tropical Cyclone Forecast Applications using GLM with Machine Learning. *2020 Fall AGU Meeting*, virtual.

2) Contributions to a “Quick Guide” on Tropical Cyclones and the Geostationary Lightning Mapper. This was assembled using the current literature as a baseline. We plan to update the quick guide with relevant findings uncovered by this machine-learning project.



Plans for Next Reporting Period

The project team is on track to complete the Year 1 milestones during the next reporting period. This includes finishing the climatological comparisons between the lightning databases and AOD, SST, and OHC to determine if any normalization is required for the lightning dataset. Additionally, GLM and ISS-LIS data will be compared to determine boundaries where GLM is suitable for applications in the Atlantic and Pacific tropical oceans. We will also finish gathering other datasets relevant for TC structure, including microwave data, aircraft flight-level reconnaissance data, tail-Doppler radar data, and satellite-based RMW estimates for TCs in preparation for Year 2 milestones.